Foreign direct investment

and the welfare effects of cost harmonization[*]

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Abstract

Foreign direct investment (FDI) gives foreign firms access to local labor and inputs, thereby harmonizing costs between foreign and domestic firms relative to exports. This paper investigates the welfare effects of such cost harmonization in strategic environments, finding that when the number of home firms is sufficiently close to the number of foreign firms, FDI reduces home country welfare, whether FDI raises or decreases foreign firms' marginal costs. Under these conditions, if production costs are identical in both countries and the domestic country practices free trade, then it is harmed if the foreign government engages in trade liberalization by reducing its subsidy (or tax) on its exporters.

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1. Introduction

During the last quarter-century the attitudes towards foreign direct investment (FDI) changed significantly in many parts of the world. For example, UNCTAD reports 1,185 policy changes in laws and regulations affecting FDI over the period of 1991-2000, of which nearly 95 percent were in the direction of making the host-country environments favorable to FDI.[1] As a consequence, FDI flows have increased at the annual rate of 20 percent during the 1990s.

This dramatic increase in FDI has spawned a large body of theoretical and empirical literature on FDI (see surveys by Hanson 2001 and Saggi 2002). The primary focus of this literature has been on "positive questions" such as what explains multinational production and what determines the location of multinational production. One important result from this literature is that, if headquarter activities are skill-labor intensive and manufacturing labor intensive, and if labor costs are cheaper overseas, then firms are likely to move production overseas while keeping headquarter activities at home.

However, even if manufacturing costs are higher overseas, FDI may still occur, to escape from high home country corporate taxes, to take advantage of reduced overhead operation cost thanks to FDI inducement measures, or even to avoid future trade conflicts with host countries. The last motive is best demonstrated in the case of the Japanese auto manufacturers. They initially exported all of their cars to the United States from Japan, where production costs are lower, but soon moved production in the U.S. to avoid trade barriers present and potential, even

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[1] This trend continues. In the 2007 survey, for example, of the 98 policy changes detected by UNCTAD, 74 cases were favorable to FDI while the 24 less favorable changes were related to extractive industries or national security reasons (UNCTAD World Investment Report 2008: Part I, page 11).

though relocation raised their production costs.[2] Whether cost increasing or decreasing, FDI brings the costs of the foreign firms more close in aligned to those of the domestic firms – a phenomenon which we dub cost harmonization.

In this paper we examine the welfare effect of FDI with emphasis on its cost harmonization aspect. Thus, our focus is on the type of FDI that replaces exports, and not on export-platform FDI.[3] While there is much literature on the positive questions about this type of FDI, there has been little analysis of the welfare implications of FDI, perhaps because the answer seems obvious.[4] When FDI lowers marginal costs, domestic firms are harmed while consumers benefit. If FDI increases marginal costs, then the effects reverse. This leads to a tradeoff between consumer welfare and domestic firm profit that seems straightforward: If the harm to domestic firms from cost-reducing FDI outweighs the benefit to consumers, then FDI deteriorates domestic welfare. Then by the logical extension cost-raising FDI in the same circumstance must

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[2]As an example of profitable cost-increasing FDI, consider a Cournot duopoly where domestic fixed costs are zero, foreign fixed costs are strictly positive, foreign marginal costs are zero and domestic marginal costs are constant and strictly positive. Straightforward calculation shows that the foreign firm would prefer FDI if foreign fixed costs (which can include trade barriers present or expected) are sufficiently greater than domestic marginal costs.

[3] The majority of FDI seems to be of this type. For example, in 2001 64 percent of total sales of foreign affiliates of U.S. multinational firms were domestic while 34 percent were exported (Ekhokm, Forsklid and Markusen 2005).

[4] The early general-equilibrium-based analysis (e.g., Helpman 1984) implies the welfare-enhancing effect of FDI but does not call for active roles for the government beyond lifting restrictions on FDI. More recent studies have identified the conditions under which promoting FDI can increase domestic welfare in the presence of market imperfections; for example, the presence of forward and backward linkages (Rodriguez-Clare 1996, Gao 1999 and Markusen and Venables 1999), missing producer service markets (Markusen, Rutherford and Tarr 2006), and foreign monopoly power (Miyagiwa and Ohno 2009).

improve domestic country welfare. However, as we show, domestic welfare can decrease, regardless of whether FDI raises or lowers the foreign firms' cost.

Specifically, consider the prototypical strategic trade model (Brander and Spencer1984a,b): one domestic firm and one foreign firm (currently exporting) that compete in Cournot competition with linear demand and constant marginal cost that differs by country of production. Then, if the foreign firm chooses FDI so that its cost equals the domestic cost, domestic welfare *decreases*.[5]

We then consider to what it extent this result generalizes. We consider *partial* cost harmonization (i.e., foreign cost with FDI become a convex combination of foreign and domestic cost) and show the result still holds. This result also extends to more firms so long as there as many domestic firms as foreign firms. However, with respect to the distribution of firms by origin, it is obvious that in the limit the result does not hold: if all firms are foreign (or domestic) the result cannot hold or is empty. However, the effect here is not a "knife's edge" result that requires that half of the firms be foreign: the distribution of firms between foreign and domestic need only be not "too" asymmetric. Furthermore, when FDI involves large changes in costs, then if the proportion of domestic firm ownership is at least 30 percent, FDI can reduce welfare, whether FDI is cost-raising or cost-reducing. In the case of cost-raising FDI, if the initial cost

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[5] Lahiri and Ono (1988) show that in an oligopoly model with asymmetric costs a cost-reducing innovation by a very inefficient firm can reduce welfare. Salant and Shaffer (1999) show that mean-preserving cost harmonization (so industry output remains constant) reduces welfare. These results are distinct from ours because there all firms are domestic and so the underlying effects differ (e.g., industry output does not remain constant here and average marginal cost can increase or decrease) and as a result some of our results run counter to their findings. Interested readers are referred to our working paper, Creane and Miyagiwa (2009) for a more detailed discussion.

difference is substantial, FDI can reduce welfare regardless of the proportion of domestic ownership. Finally, there is a "bang-bang" type of result: it is welfare optimal that either all or no foreign firms choose FDI.

Our findings naturally have implications on other work on FDI. For example, consider recent work on examining the role uncertainty has on FDI under strategic competition; e.g., Sung and Lapan (2000) for exchange rates uncertainty and Qiu and Zhou (2006) for demand uncertainty with learning. Our findings suggest that when the exchange rate uncertainty affects costs, the welfare effects for the domestic country are not solely driven by uncertainty since FDI also has a cost harmonization effect. Likewise, the results under demand uncertainty may not carry over to the case of cost uncertainty due to the cost harmonization effect of FDI.

Our results have more general implications since cost harmonization is a phenomenon not unique to FDI. Cost harmonization is a quintessence of globalization and also occurs with falling transport costs or elimination of trade barriers. For example, suppose domestic firms compete with foreign exporters in the domestic market, where foreign firms are subject to transport costs. Then our analysis implies that falling transport costs can decrease domestic welfare if more than 30% of the firms are domestic. If cost harmonization is due to tariff removal then this ownership limit will be even smaller because of the loss of tariff revenues. Furthermore if the domestic country practices free trade (has no tax or subsidy on its home producers), then under our conditions *it is harmed if the foreign government liberalizes trade*: the foreign government reducing its export subsidy (or tax) on its producers reduces domestic welfare.

The remainder of the analysis is organized in four sections. The next section presents the basic model. Section 3 is the main section. Section 4 extends the model to the case of incomplete cost harmonization, and also discusses the application to the strategic trade model. Section 5

concludes.

2. Model

Suppose n firms compete in the domestic country, of which n_d are domestic and n_f are foreign; $n = n_d + n_f$. All firms face linear production costs, which depend only on the country of production. Thus, foreign firms face constant marginal costs c_f when they export but c_d if they locate in the domestic country. Domestic firms always produce at home, facing (constant) marginal costs c_d.

Let x denote the number of foreign firms located in the domestic country. Thus, $n_d + x$ firms produce at marginal cost c_d in the domestic country while $n_f - x$ foreign firms export from the foreign country at c_f. While x is discrete, we find it convenient to treat x as a real number x.

Turning to the market demand, we consider a representative consumer model with quadratic preferences given by $U(Q) = Q - Q^2/2$, where Q is aggregate output. From this aggregate inverse demand is given by $P = 1 - Q$, with $Q = \sum_{j=1}^{n} q_j$. They compete Cournot fashion so a representative firm i chooses output q_i to maximize profit

$$(1 - \sum_{j=1}^{n} q_j - c_i)q_i.$$

We focus on an interior solution: the values of c_d and c_f are such that all firms produce in equilibrium. From the first order conditions of all the firms, a firm producing locally, be it foreign or domestic, has equilibrium output

$$q_d(x) = [1 - (n_f + 1)c_d + n_f \cdot c_f + x \cdot (c_d - c_f)]/(n + 1),$$

while a foreign firm that exports has equilibrium output

$$q_f(x) = [1 - (n_d + 1)c_f + n_d \cdot c_d + x \cdot (c_d - c_f)]/(n + 1).$$

With $n_d + x$ firms producing domestically and $n_f - x$ firms exporting, aggregate output is

$$Q(x) = [n - n_d \cdot c_d - n_f \cdot c_f - x \cdot (c_d - c_f)]/(n + 1).$$

From these expressions the profits to the representative firm producing domestically is

$$\pi_d(x) = q_d(x)^2$$

Given the preferences on our representative consumer, consumer surplus is

$$CS(x) = Q(x)^2/2.$$

Domestic welfare comprises consumer surplus and total profits to domestic firms so we write:

$$W(x) = n_d \cdot \pi_d(x) + Q(x)^2/2.$$

3. Welfare effects of FDI

We suppose that $x = 0$ initially, i.e., the status quo has all foreign firms exporting from their home countries. We assume the domestic government can freely control the number of firms establishing local plants, say, by issuing FDI permits. Thus, x can be less than n_f. Then, a welfare change due to FDI is expressed as

$$W(x) - W(0) = \int_0^x W'(y)dy \tag{1}$$

where

$$W'(x) = (2n_d q_d(x) - Q(x))(c_d - c_f)/(n + 1) \tag{2}$$

measures marginal welfare impact of FDI. Equation (2) identifies two factors affecting a welfare change due to FDI. One is the cost differential, $c_d - c_f$. This term captures the direction of a price change, and is positive if and only FDI reduces cost. The other is the market share of the domestic firms, $2n_d q_d(x) - Q(x))$. This term captures a change in domestic firm welfare relative to consumer welfare. In our model it is positive if and only if the domestic firms have more than half the market in terms of sales; $n_d q_d(x) > Q(x)/2$. Differentiating (2) further yields

$$W''(x) = (1 + 2n_d)(c_d - c_f)^2/(n + 1)^2 > 0, \tag{3}$$

implying that $W(x)$ is convex in x, which leads immediately to this lemma.

Lemma: (A) if $W'(0) > 0$, FDI is welfare-improving.

(B) if $W'(0) < 0$ and $W'(x) < 0$, FDI is welfare-decreasing.

(C) If $W'(0) < 0$ and $W'(x) > 0$, then max $\{W(0), W(x)\} \geq W(y)$ where $0 < y < x$.

The next proposition is an immediate consequence of the lemma.

<u>Proposition 1</u>: Domestic welfare is maximized when either all the foreign firms export or they all switch to FDI.

Thus, the optimal policy towards FDI is either banning FDI altogether or permitting all foreign firms to switch to FDI. Then to examine the welfare impact of FDI all we need is to compare welfare at $x = 0$ and $x = n_f$.

The lemma has another immediate implication. When there are no domestic firms, the domestic output is clearly less than half the industry output, so by Equation (2) FDI improves

domestic welfare if and only if it is cost-reducing.

We proceed to examine two familiar cases in the literature.

Case $n_d = n/2$ (half the firms are domestic)

This case includes the standard Cournot duopoly case of one domestic and one foreign firm. If half the firms are domestic, the domestic firms can have more than half the market if and only if domestic cost is lower, $c_d < c_f$. Thus, the market share term and the cost differential term in (2) have the opposite sign, and hence $W'(x) < 0$ for all relevant x. Then by the lemma and continuity we obtain

Proposition 2: When sufficiently close to half of all producers are domestic, FDI reduces domestic welfare regardless of whether domestic marginal costs are lower or higher than foreign ones.

Case: $n_d = n - 1 > 1$ (all firms but one are domestic).

In this case, there is one foreign firm or $n_f = 1$. Assume $n_d \geq 2$ to separate from Case 2. From straightforward computation we have

$$W'(0) = [(n - 1)q_d(0) - q_f(0)](c_d - c_f)/(n + 1)$$

$$W'(1) = (n_d - 1)q_d(1)(c_d - c_f)/(n + 1).$$

If $c_d < c_f$, then $q_d(0) > q_f(0)$, so $W'(0) < 0$. Further, $W'(1) < 0$. Thus, cost-reducing FDI decreases domestic welfare. Intuitively, an output expansion by the lone foreign firm (whose cost was higher with exporting) induces all domestic firms to contract output but since domestic firms are

more efficient than the foreign firm domestic welfare falls.

Since cost-reducing FDI reduces welfare, one is tempted to conclude that cost-raising FDI must increase domestic welfare in this case. Surprisingly, however, this symmetry in results does not always hold. To see this, note that if $c_d > c_f$, we then have $W'(1) > 0$. However, if $W'(0) < 0$ or

$$(n-1)q_d(0) - q_f(0) < 0, \tag{4}$$

the lemma implies that domestic welfare can still fall as a result of FDI. Condition (4) is likely to be satisfied if $q_d(0)$ is sufficiently small relative to $q_f(0)$ or c_d is sufficiently higher than c_f.[6] Of course, a symmetry in results can occur too. If c_d is sufficiently close to c_f, condition (4) is reversed so $W'(0) > 0$. Therefore, by the lemma FDI increases domestic welfare.

Proposition 3: Suppose there is only one foreign firm ($n_f = 1$). Then:

(A) cost-reducing FDI decreases domestic welfare, while

(B) cost-increasing FDI increases domestic welfare if the domestic cost is sufficiently close to the foreign cost.

The above cases illustrate the importance of the distribution of firm ownership in the welfare analysis of FDI. For cost-increasing FDI, welfare decreases if there are no domestic firms but may increase welfare if there are a sufficient number of domestic firm. However, if the cost gap is sufficiently high, welfare may never improve with FDI, no matter what the proportion

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[6] The maximum c_d that results in an interior solution (all firms produce) is $c_d = (1 + c_f)/2$, obtained by solving $q_d(0) = 0$. At that value of c_d, $q_f(0) > 0$ and hence (4) holds.

of domestic firm ownership (the proof in the appendix).

Proposition 4. If the domestic cost is sufficiently high relative to the foreign cost, FDI by all foreign firms can lower domestic welfare no matter how large the share of domestic production.

For cost-reducing FDI, domestic welfare increases if there is no domestic ownership but decreases when domestic ownership exceeds 50%. In fact this limit can be pushed down to 40% for a sufficiently large cost gap (see the proof in the appendix). This, together with Proposition 4, leads to the following general result.

Proposition 5: When at least 40% of the firms are domestic, FDI by all foreign firms reduces domestic welfare when marginal cost differentials are sufficiently large, *regardless* of whether domestic marginal costs are lower or higher than foreign ones.

We close this section by noting that because of the convexity of the welfare function our analysis has focused on whether to have all foreign firms engage in FDI or none. Not surprisingly given the convexity, some of our results strengthen when consider the effect of a single foreign firm choosing FDI over exporting. In particular, the result in proposition 5 is even stronger: only 30% of the firms need be domestic for FDI by one firm to reduce welfare under these conditions. Interested readers are referred to our downloadable working paper, Creane and Miyagiwa (2009) for the derivations in this case.

4. Incomplete cost harmonization

So far we have focused on complete cost harmonization, i.e., marginal costs for domestic and foreign firms are equated as a result of FDI. It is straightforward to generalize the model so that by choosing FDI the foreign firm's marginal cost only partially approaches c_d, that is, go from c_f to $\rho \cdot c_d + (1-\rho) \cdot c_f$, $\rho \in (0,1]$, where $\rho = 1$ is the complete harmonization. In this section we consider how partial harmonization affects our results, and how our model can be re-interpreted to evaluate welfare impact of globalization.

Proceeding as before, and slightly abusing notation, we can show that a domestic firm produces

$$q_d(x) = [1 - (n_f + 1)c_d + n_f \cdot c_f + x \cdot \rho(c_d - c_f)]/(n + 1).$$

while a foreign exporter produces

$$q_f(x) = [1 - (n_d + 1)c_f + n_d \cdot c_d + x \cdot \rho(c_d - c_f)]/(n + 1).$$

New to this extension is a group of foreign firms that produce in the domestic market with costs between c_f and c_d. Computation shows such a firm has the equilibrium output equal to

$$q_{df}(x) = \{1 - (n + 1)[\rho c_d + (1 - \rho)c_f] + n_d \cdot c_d + n_f \cdot c_f + x \cdot \rho(c_d - c_f)\}/(n + 1).$$

Substituting and simplifying we obtain equilibrium aggregate output:

$$Q(x) = [n - n_d c_d - n_f c_f + x \cdot \rho(c_d - c_f)]/(n + 1).$$

With partial harmonization the derivative of $W'(x)$ now is

$$W'(x) = \rho(2n_d q_d(x) - Q(x))(c_d - c_f)/(n + 1).$$

This is identical to (2) except the presence of the term ρ. Further, welfare is still convex in x:

$$W''(x) = [\rho(1 + 2n_d)(c_d - c_f)/(n + 1)]^2 > 0.$$

These observations imply that our results from the previous sections carry over intact to the case of incomplete cost harmonization.

Our results also shed light on welfare impact of falling transport costs – another feature of globalization. To see this, assume there is no FDI and foreign firms export their products initially at cost $c_f > c_d$, where the cost difference is due to transport costs. Then ρ is the inverse of transport costs – a measure of globalization, with $\rho = 1$ indicating the case of complete cost harmonization. Then, $W(n_f) - W(0)$ measures a welfare change caused by lower transport costs. The implications are straightforward: for example, the domestic country is harmed by falling transport costs when the domestic firms have the majority of the market.

Our results also have some implications for the strategic trade policy literature. To see this, consider the classical works by Brander and Spencer (1984a, 1984b), in which one home and one foreign firm compete Cournot fashion in the domestic market. In this setting the authors showed that the optimal tariff is positive,[7] which implies that trade liberalization or removal of the (optimal) tariffs decreases domestic welfare. While this welfare loss is often attributed to the lost tariff revenues, our analysis shows that domestic welfare falls without the loss of tariff revenues. Since trade liberalization induces cost harmonization, like cost-reducing FDI, all the results from the previous sections apply. If the revenue losses are taken into account, domestic welfare can decrease even if domestic firms are less than 40 percent.

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[7] Unless demand is highly convex.

As another application consider the case in which the domestic country practices "free trade" but the foreign government either taxes or subsidies its firms' exports to the domestic market. Then, our analysis implies that the domestic country is made worse off if the foreign government moves to freer trade by reducing its tax (or subsidy) on its exporters.

5. Concluding remarks

In this paper we consider the welfare implications of FDI under Cournot oligopoly, finding an over-looked effect: cost harmonization between domestic and foreign firms. We find that with linear demand and constant marginal costs, if domestic firms produce at least 40 percent of total output, then FDI can decrease domestic welfare, whether FDI decreases or increases costs for investing foreign firms. Cost harmonization also occurs with falling transport costs or tariff elimination and therefore can decrease domestic welfare under the same condition.

Finally, if FDI reduces marginal cost, it is natural to wonder if the domestic country can tax FDI to capture this efficiency gains. If the domestic country can impose a lump-sum tax to extract all the efficiency gains that would accrue to the foreign firms, indeed the domestic country can increase welfare with FDI. Thus, the key to the welfare effect would be what fraction of the efficiency gains the country could capture.

Appendix: Proof of Proposition 4 and 5:

Let $s = n_d/n$ denote the proportion of firms that are domestic. Substituting, we obtain

$$W(0) = s \cdot n\{1 - (1 + n(1 - s))c_d + n(1 - s)c_f\}^2/(n + 1)^2$$

$$+ n^2[1 - sc_d - (1 - s)c_f]^2/[2(n + 1)^2].$$

$$W(n_f) = s \cdot n(1 - c_d)^2/(n + 1)^2 + n^2(1 - c_d)^2/[2(n + 1)^2].$$

Hence, after manipulation we obtain

$$W(n_f) - W(0) = -A \cdot n^2(1 - s)(c_d - c_f)/[2(n + 1)^2]$$

where

$$A = (1 - s)(1 + 2s \cdot n)(c_d - c_f) + 2(1 - 2s)(1 - c_d)$$

Suppose that $c_d > c_f$. Then $W(n_f) < W(0)$ if and only if $A > 0$. We compute for given c_f the

largest c_d such that $q_d(0) = 0$. We then substitute that value, $c_d = [1 - (1-s)n \cdot c_f]/[1 + (1 - s)n]$,

into A, finding after collecting terms that $A > 0$ if and only if

$$(1 + 2s \cdot n) + 2n(1 - 2s) = 1 + 2n(1 - s) > 0.$$

Since the last inequality holds for any n and s, we have proved Proposition 4.

Suppose next that $c_d < c_f$. Then, $W(n_f) < W(0)$ if and only if $A < 0$. We then compute for

given c_d the largest c_f such that there are interior solutions: $c_f = (1 + s \cdot n \cdot c_d)/(1 + s \cdot n)$. Substituting

this, $A < 0$ if and only if $2(1 - 2s) - (1 - s)(1 + 2s \cdot n) < 0$. This is satisfied only if

$$s > \frac{3 + 2n - \sqrt{4n^2 + 4n + 9}}{4n}.$$

The right hand side is decreasing in n, so evaluating it at $n = 2$ we find that $A < 0$ if $s > (7 -$

$35^{1/2})/8 \approx 0.39$. This and Proposition 4 prove Proposition 5.

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